利用大数据系统的AI技术优化测试成本
Optimizing testing costs using AI technology in big data systems

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Agenda

- Algorithms and Models

1. Build Data System
2. Preprocessing & Feature Selection
3. Model Construction
4. Validation with Real Case

Reduce Test Cost By Shifting Left

Low Yield Root Cause Identification

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2

What kind of data systems semiconductor companies need?

Production yield management system
Data-driven decision-making and analysis

A system that integrates data management, data analysis, and professional tools, which can collect and analyze data in wafer fabrication, packaging testing, etc., and help engineers quickly find the key points to improve yield.

Production test management system
Quality control and defect handling

Use big data algorithms to detect anomalies perform online defect handling, accumulate product failure models, and manage the product quality baseline with the product grade.

Product engineering operation management system
Product lifecycle management

Connect the Product Lifecycle Management (PLM) to manage the relevant information of the product, including effective Test plan, Test Program, and Test Case management, can effectively manage the PCN/ECN change process, and support the evaluation of product and process revision changes

R&D-production feedback system
Product life cycle management

Connect mass production and design teams, discover design defects through mass production big data mining, track testability design data to find production defects, improve yield; and achieve design and mass production linkage.

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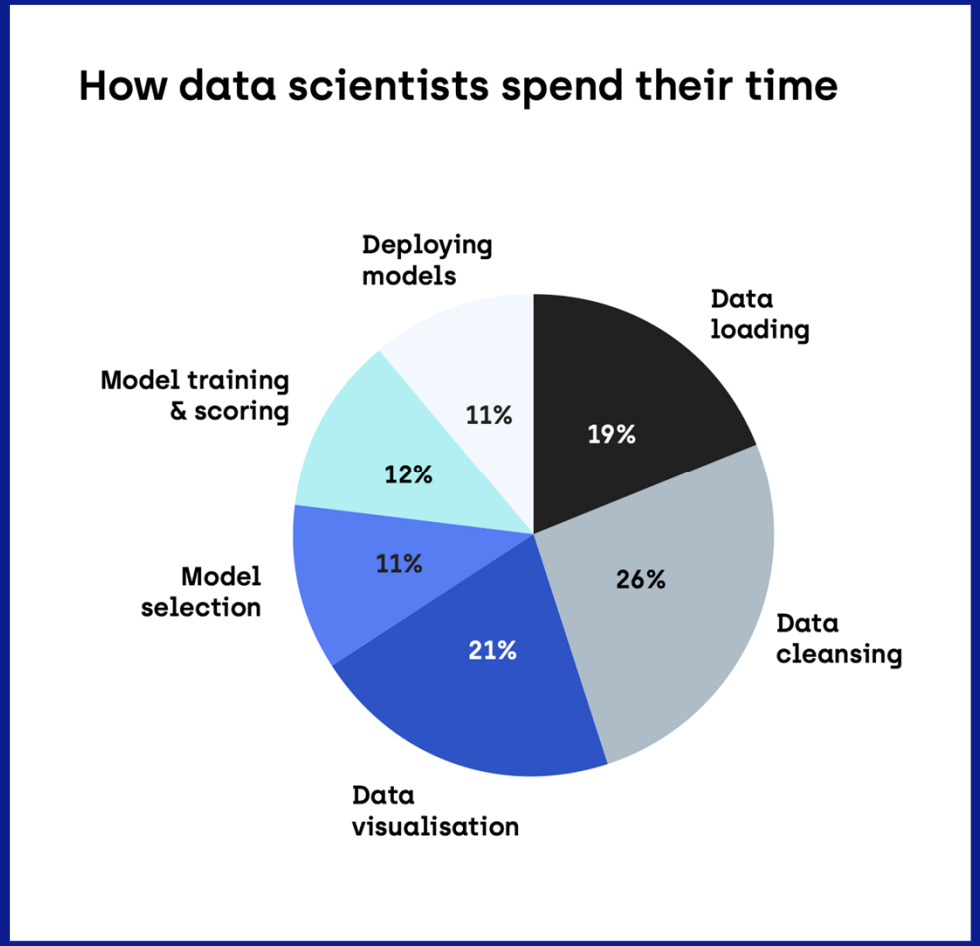

Why Database Is Important

- **Databases Considerations**
  - Automatically import data
  - Summarized data can be pre-calculated
  - Unified data format
  - Efficiency of data query
  - Long Time Historical Data
  - Concurrency mechanism
  - Network port
- **Advantages of big data database**
  - Big data structures enable faster data capture and computing performance, greatly improving the speed of analysis
  - Data is automatically correlated and aligned to different data types
  - Flexibly scale the size of your database on demand
  - Scalable industry data types, more flexible customization, import of arbitrary information

Gubo OneData Big Data Product Matrix

Comprehensive Analytics Big Data Platform

- Faster NPI ramp-up analysis during the engineering and ramp-up phases
- Achieve clearer and more comprehensive yield management and yield improvement in the mass production stage
- Achieve more consistent quality and reliability in large-scale production processes
- Cost optimization for overall operations management and transparency of supply chain processes

One-stop Manufacturing Operations Platform

- Transparency in the production process to enhance control over outsourced factories.
- Closed-loop tracking and processing of the production process and factory docking to ensure business closure.
- Digital operation for deeper insight and estimation of costs.

Design Spec Compliance Matrix

- Ensure that the tracking of Spec requirements is closed
- Clearer, actionable insights into your test data
- More than 15 years of data traceability to ensure long-term audit and analysis

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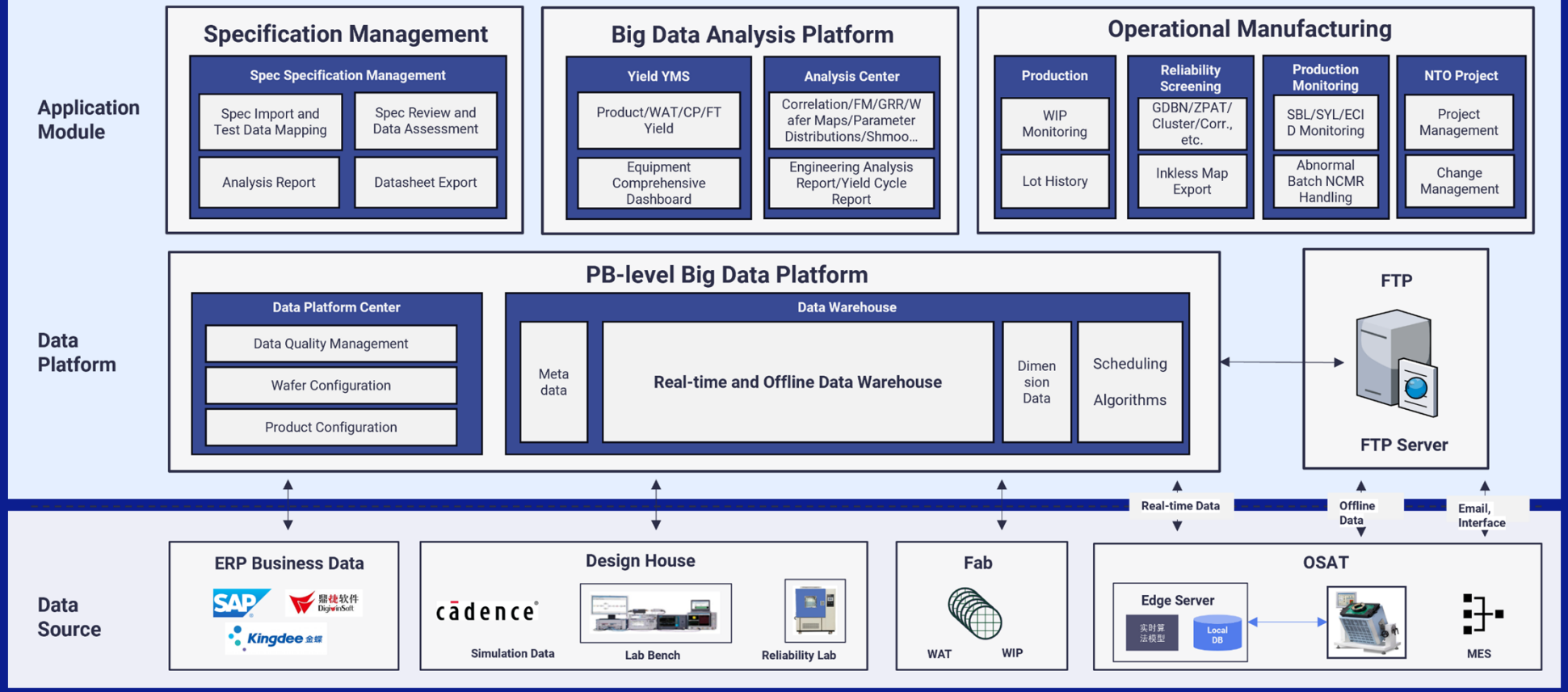
OneData Big Data Product Structure



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Real-time + Online + Offline

Edge

Central Cloud

Machine Side

Tester OS

Tester Client

Wrapping data Tester control

Prober/Handler

Test Data Stream

Tester Command API

Edge Service (Online & Real-time)

Real Time Service

Real Time Algorithm Plugins (e.g. DPAT) Configuration GUI (e.g. Algo Config)

Real-time Algorithm Model

Local Database

Big Data Storage and Computing Platform

Real-time Warehouse Computation

Offline Test Data Warehouse

Web Application

Mass Production Dashboard

Analysis

Offline Rule Debugging

Real-time

- Close to Test Cell
- Provides data analysis and machine control at the per test item / touchdown / lot level
- Common usage scenarios
- Binning control (DPAT / ATTR, etc.)
- SPC inline yield monitoring, downtimes, etc.
- P/H control for real-time needle cleaning or re-penetration

Offline

- Cloud Architecture
- Real-time and Offline Warehouses
- Provides real-time data feedback from packaging factories, yield monitoring, and supports online and offline rule deployment
- Common usage scenarios
- Engineering and mass production data analysis
- Data traceability across stages
- Automotive RS Ink
- Quality rules

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7

Reduce Test Cost By Shifting Left

- Build models using historical cross-stage data from SLT/FT/CP.
- Implement Ink Algorithm on CP, screening risk Die to save packaging costs

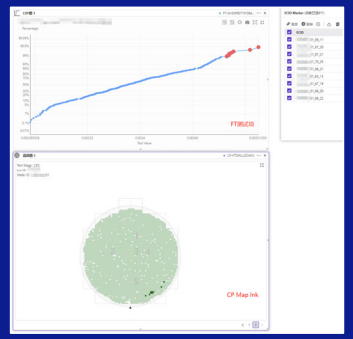
Cross-stage Outlier Tracing via RMA returns or FT failures

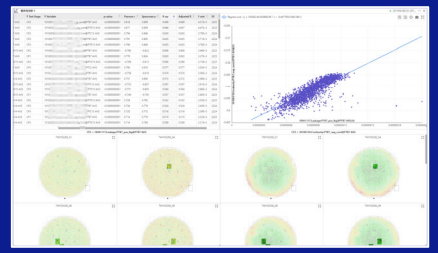
Select related FT/SLT-CP sample chip data

Construct Outlier model algorithm

During the CP phase, find CP risk Die based on the model algorithm

and perform Ink in future CP Maps





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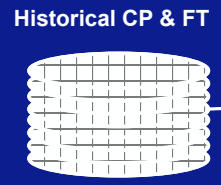
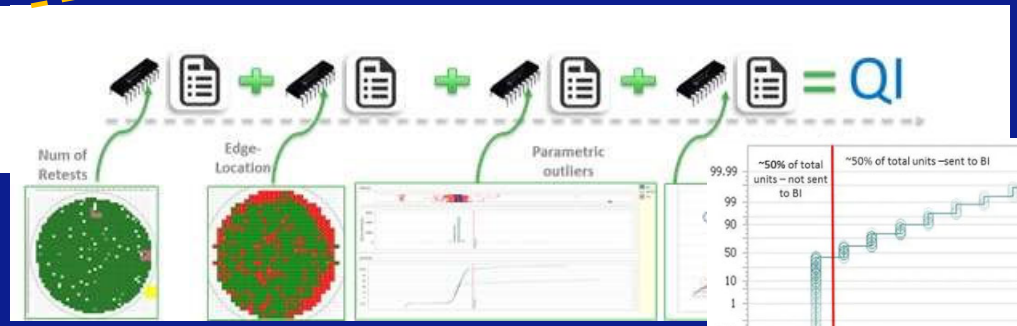
Determine SLT/BI Based on Quality Index (QI) Model

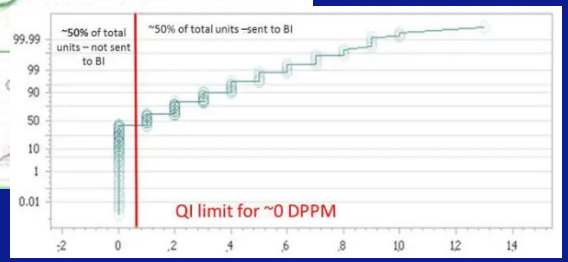


Select Associated FT-SLT Sample Chip Data

Build Chip QI Model

Use CP-FT QI Indicators to Set Limits for BI Testing and Chip Classification





#	Feature Group	Example
1	Geographic location profile of part on wafer /board	Distance from wafer/board edge
2	Part neighborhood profile	k - nearest neighbors average yield
3	Retesting history of part	Number of retests on part
4	Test equipment profile	Average test time per part
6	Outlierness of part on important tests	Number of tests with test value near the upper or lower bound of SPC
7	Part test profile	Test sequence encoding

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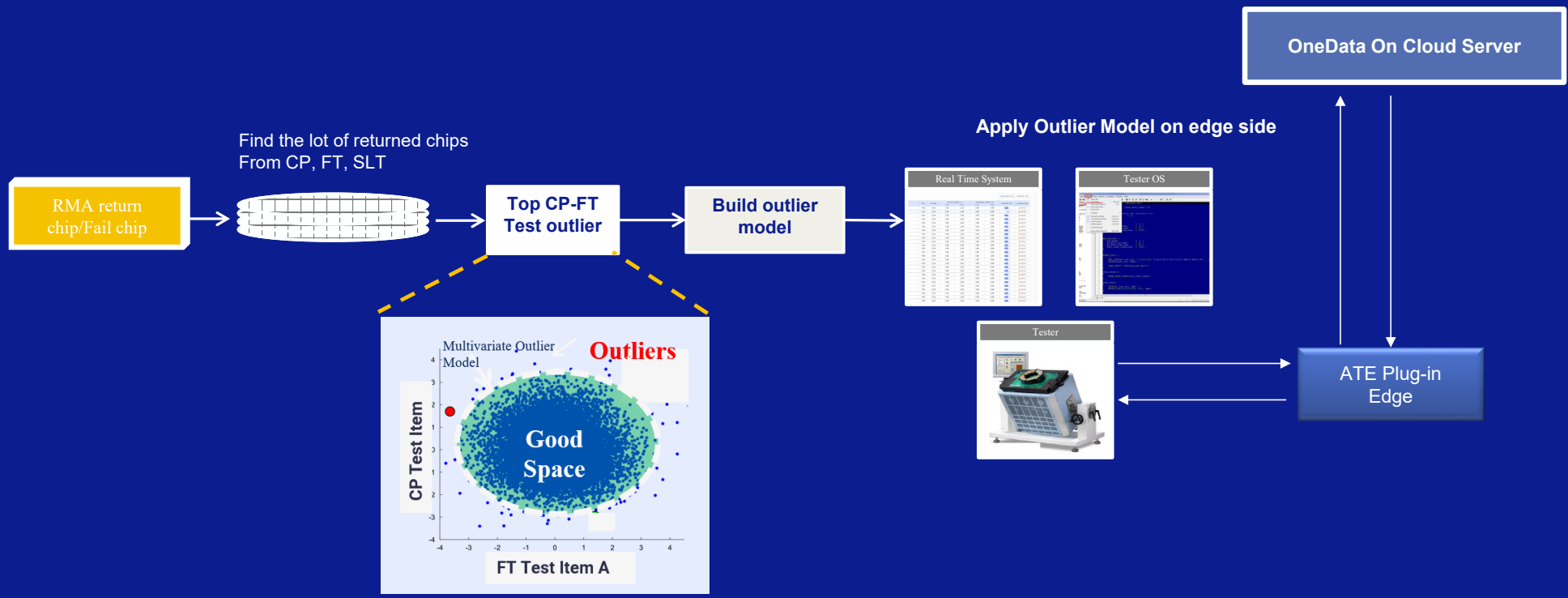
Building Outlier Modeling

Apply real-time algorithms at FT ATE edges to prevent abnormal chip escape



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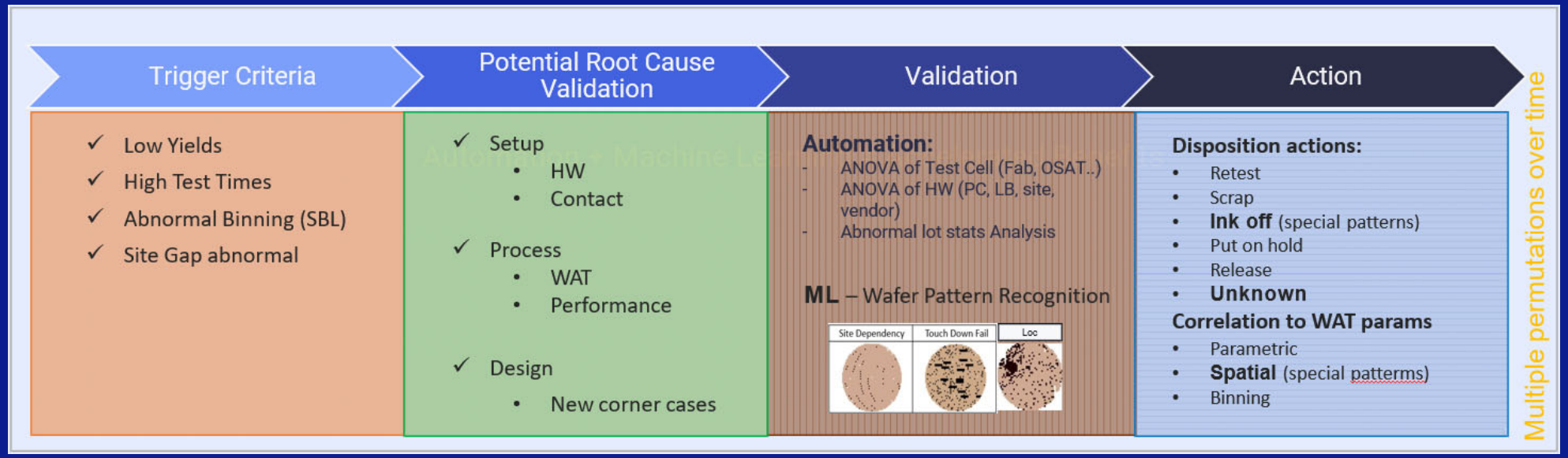
Low Yield Root Cause Identification for lot disposition

Assisted Disposition: ML and Automation Improved Product Quality and Operational Efficiency



Automation + Machine Learning = Accelerated Benefits

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